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Department of
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April 30, 2009

Ms. Denise Koch
Program Manager,
ADEC/Division of Water CPVEC
410 Willoughby Avenue, Suite 303
P.O. Box 11800
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RE: 2009 Alaska Pre-Season Report

Dear Ms. Koch:

This is to transmit the 2009 Alaska Pre-Season Source Reduction Report which we are submitting pursuant to the Large Commercial Passenger Vessel Wastewater Discharge General Permit No. 2007DB002. This Pre-Season Report summarizes activities and information gathered since the January 14, 2009 Source Reduction Annual Report submitted pursuant to our approved Source Reduction Evaluation Plan under Section 1.9 of the Alaska Reduction Annual Report, as well as outlines tasks anticipated we will conduct during the 2009 Alaska season.

Please feel free to contact me if you have any questions or concerns.

Sincerely,



William J. Morani, Jr.
Vice President Environmental Management Systems

WJM/jg

Attachment: 2009 Alaska Pre-Season Source Reduction Report



Holland America Line

Source Reduction 2009 Alaska Pre-Season Report

April 30, 2009

**Submitted per Section 1.9
Of the
Large Commercial Passenger Vessel
Wastewater Discharge General Permit
No. 2007DB0002**

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Executive Summary

This report provides an update of source reduction activities conducted by Holland America Line pursuant to authorization to discharge under §1.9 of the Large Commercial Passenger Vessel Wastewater Discharge General Permit No. 2007DB0002. This report describes activities conducted and plans formulated since the Source Reduction Evaluation Annual Report was submitted in January 2009.

Principal activities described in this report are:

1. HAL Technical Advisory Committee Convenes
2. Steiner Spa and Salon product Data Analysis
3. Ammonia Reduction Project, conducted jointly with Princess Cruise Line
4. Strategic Water Bunkering Plan
5. Water Use Reduction
6. Laundry waste water investigation

Each of these will be covered briefly in this summary, and discussed in detail in the body of this report.

We have received product usage and constituent data from Steiner Leisure LLC. Analysis of this information leads us to conclude that these products are not a contributor to ammonia, copper, nickel or zinc concentrations in our effluent in other than trace amounts.

Carnival Corporation has provided resources with which to conduct a pilot ammonia reduction pilot study in conjunction with Hamworthy plc. The Princess Cruise Line vessel *Golden Princess* was selected as the ship on which to conduct pilot project activities. Holland America Line and Princess Cruises are working collaboratively on this effort. Hamworthy has conducted initial studies to characterize the waste water influent as a precursor to system design and operation. Lessons learned from this effort will be applied to Holland America Line systems as the technology is further developed.

HAL is developing a strategic bunkering strategy to optimize selection of water sources to minimize the introduction of copper, nickel and zinc into the potable water systems when operating in Alaska. Water sourcing and constituent concentrations have been modeled and bunkering guidelines will be developed and deployed on an itinerary specific basis.

HAL is engaged in water use reduction efforts which, it is anticipated, will reduce the total discharge of water from HAL vessels. This has the potential to reduce contaminant loading by reducing leaching and/or mechanical erosion. It is unclear whether this will result in lower *concentrations* of metals, as the total flow will also be reduced.

HAL is engaged with a vendor to evaluate new laundry technology that should result in the use of less water with lower temperatures, as well as less laundry detergents. Laundry gray water was determined to have elevated concentrations of copper in previous studies. Reduction of these factors has the potential to reduce metals concentrations in the waste water.

1. HAL Technical Committee

Holland America Line has convened a Technical Committee to establish and guide progress on the below described activities. The team is comprised of two representatives from the Environmental Management Systems Department, and a member each from the Technical, Nautical, and Marine Hotel Departments.

2. Steiner Spa and Salon Product Analysis

The January 2009 Source Reduction Annual Report did not include data from the Steiner Spa and Salon products. We have since completed this data gathering project and identified those products containing a constituent of concern that drain to the gray or black water system. A complete listing is found in Appendix A of this report. The products identified per the above criteria as potentially contributing to elevated contaminants in the discharge effluent are listed in the table below:

Figure 1: Steiner Spa Products of Concern

PART NO	Description	Daily Avg. Use	Copper	Nickel	Zinc	Ammonia	Gray / Black Water	Chemical of Concern	Percentage/Concentrate
1000003	Blonder Special 800G	15 grams	no	no	no	yes	yes	Ammonium Persulfate	<5% - 10%
	Hair Color - Color Touch Hair Color - various 11	.5 oz	no	no	no	yes	yes	Ammonium Sulphate	max <1%
	Hair Color - Koleston Perfect Hair Color - various 34	1.5 oz	no	no	no	yes	yes	Ammonium Sulphate / Ammonia	max 2% 5% < 15%
1000155	Barbicide Liquid 16 oz	2.03oz	no	no	no	yes	yes	Dimethyl Benzyl Ammonium Chloride	5.12%

As in our January 2009 Annual Report, we then performed an analysis to determine whether these products, at these usage levels and concentrations, had the potential to significantly impact the quality of the discharge. The table below shows the chemical formulas for the compounds of concern listed above. Using molecular weights, we estimated the maximum amount of the compound that could express as ammonia in the discharge, expressed as a percentage of the compound.¹

¹ The analysis for Barbicide is slightly different. The chemical formulas, percentages and molar mass were provided by the manufacturer. Given the formulation, nitrogen is the limiting element. Because neither NH₃ nor NH₄ are in the formulation, we made the conservative assumption that ALL nitrogen present in the compound would subsequently assume the form of NH₃ or NH₄. Even with this very conservative assumption, the resulting ammonia concentrations would not significantly impact the effluent concentration.

Figure 2: Estimated Ammonia Contributions from Salon/Spa Products

A. Product Description	B. Daily Avg use in grams	C. Chemical of Concern	D. Percentage Concentrate	E. grams of compound of concern per day (B x Max. D)	F. Chemical formula	G. Molar Mass of Compound (g/mol)	H. Moles of compound	I. Moles of NH ₃ or NH ₄ ⁺	J. Grams of NH ₃ or NH ₄ ⁺	K. Maximum ug/L NH ₃ or NH ₄ ⁺ based on 600m ³ /day
Blonder Special 800G	15.00	Ammonium Persulfate	<5% - 10%	1.50	(NH ₄) ₂ S ₂ O ₈	228.18	6.57E-03	1.31E-02	2.37E-01	0.39
Hair Color - Color Touch Hair Color - various 11	14.18	Ammonium Sulphate	max <1%	0.14	(NH ₄) ₂ SO ₄	132.14	1.07E-03	2.15E-03	3.86E-02	0.06
Hair Color - Koleston Perfect Hair Color - various 34	42.53	Ammonium Sulphate	Max 5%	2.13	(NH ₄) ₂ SO ₄	132.14	1.61E-02	3.22E-02	5.79E-01	0.97
		Ammonia	Max 15%	6.38	NH ₃	17.03	3.75E-01	3.75E-01	6.37E+00	10.61
Barbicide Liquid 16 oz	57.55	Dimethyl Benzyl Ammonium Chloride	5.12%	2.95	C ₂₁ H ₃₉ NCl (40%) C ₂₂ H ₄₂ NCl (50%) C ₂₁ H ₄₆ NCl (10%)	359.055	8.21E-03	8.21E-03	1.48E-01	0.25
Long Term Permit Limit for Ammonia: 2.9 mg/L = 2,900 ug/L									total	12.28 ug/L ammonia

On the basis of this analysis, we have concluded that spa and salon product contributions from these products would represent, at the most,

$$(12.28\mu\text{g/l}) / (2900\mu\text{g/l}) = 0.0042 = 0.42\% \text{ of the long-term-limit}$$

or less than one half of one percent of the long term limit of 2.9 mg/L (2,900 µg/L). As such we do not believe spa and salon products are a significant contributor of ammonia to this waste stream, particularly when compared to that of black water (urea).

3. Ammonia reduction project

Carnival Corporation has committed \$250,000 to \$500,000 in pursuit of ammonia reduction technology on board the Golden Princess. This allocation was made with the understanding that the ammonia nitrification/de-nitrification process is best explored with a pilot on one ship, and therefore on one operating line, rather than to divide resources among several. Although Carnival Corporation has proceeded by funding one member line, it has always been understood that knowledge gained would be shared with other sister lines. Carnival Corporation has operated in this manner in a number of technology development projects, including the initial development of advanced wastewater treatment and the seawater scrubber, in which HAL has taken the lead, and ballast water treatment in which Princess Cruise Lines has been the principal participant.

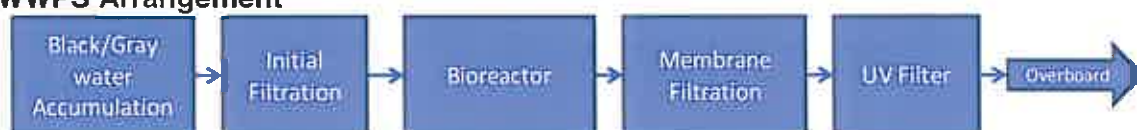
Holland America Line and Princess Cruise Lines are working collaboratively with Hamworthy to develop and evaluate ammonia reduction technology to be installed on board the Golden Princess. Hamworthy has proposed a plan in which modifications will be made to an existing treatment system to facilitate nitrification / de-nitrification thus reducing ammonia levels.

On April 2, 2009, the Hamworthy Technical Lead provided a status briefing to both Princess and HAL representatives at the Princess Cruise Lines Corporate Headquarters in Santa Clarita California. Thus far, Hamworthy has focused on establishing baseline information on the quality

of the influent to the treatment system but has not yet converted a bio-reactor to facilitate introduction of nitrifying bacteria into the system. On board sample points have been established, as well as on board analytical procedures for monitoring of process performance. Flow rate analysis has been conducted to determine the likely loading patterns on the treatment facility once it is installed.

Although Princess and HAL have different wastewater treatment systems by different manufacturers, it does not follow that the technology developed under the Princess/HAL collaboration would not be transferrable. The Hamworthy systems operated by Princess, and the Zenon and Rochem systems operated by HAL while different, have the same basic approach illustrated below:

Basic AWWPS Arrangement



The approach taken in the Princess/HAL effort will be to initiate ammonia reduction by partitioning one of three on-board bioreactors and to introduce and maintain a population of both nitrosomonas and nitrobacter bacteria (collectively referred to as “nitrifiers”) to bring about the desired ammonia reductions. This is illustrated below:

Proposed Nitrification/De-nitrification schematic



These additional bacterial populations must be maintained respectively in aerobic and anoxic environments, requiring segregation of the bioreactor. This tank segregation is relatively straightforward to adapt to any variety of systems following the basic treatment steps described above.

This is not to imply that adaptation of the Golden Princess system, once deemed successful, will be “plug and play” on Holland America Line ships, or for that matter even on other Princess ships. Early data indicate that the system will be sensitive to variation in terms of flux, influent water quality and the overall environment in which the bacteria must thrive. Such factors will vary between vessels, even between those with *identical* treatment systems. Despite such complexities, as are typical in any technology development effort, we have every reason to believe that the lessons learned and technology advanced on the Golden Princess will be adaptable to Holland America Line vessels, as well as any vessel operating the basic bio-digestion / membrane filtration approach.

Hamworthy will make necessary modifications to install and evaluate this technology during the summer 2009 Alaska season.

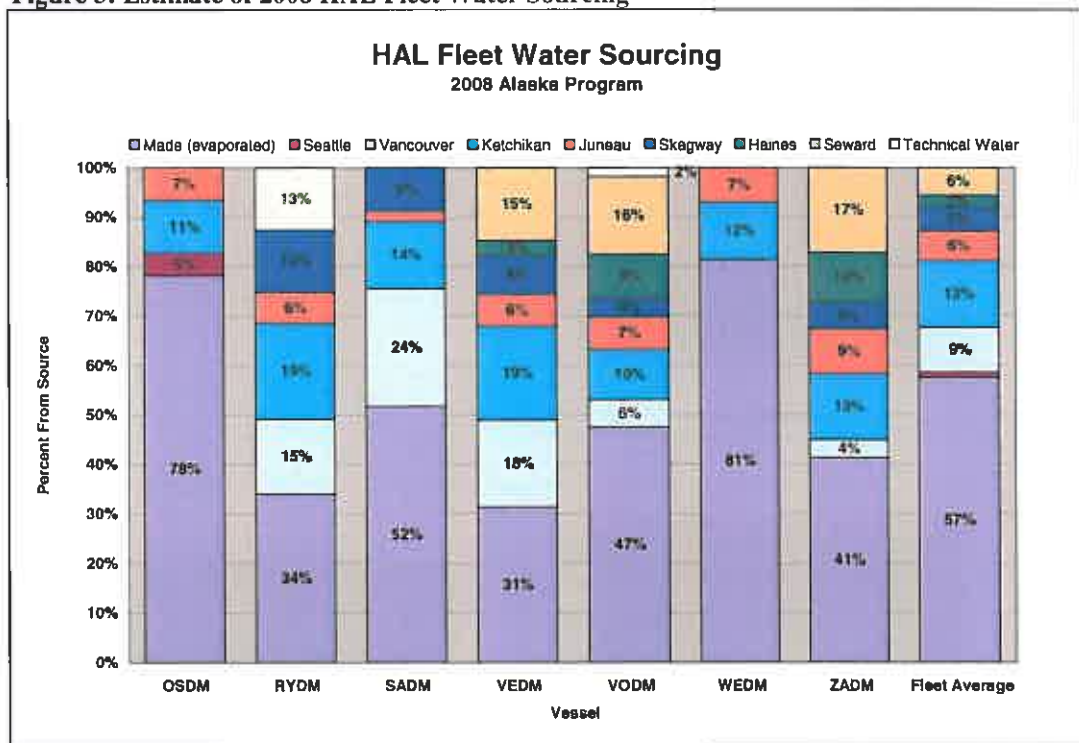
4. Strategic Bunkering

The Source Reduction Annual Report identified several shore-based water supplies that contribute contaminants of concern to the potable water supply of HAL vessels sailing in Alaska. While this water meets any drinking water standard, the presence of copper, nickel or zinc would contribute to exceedances in the waste water effluent.

HAL is initiating a water bunkering guideline intended to minimize the potential for bunkered water to cause effluent exceedances. These guidelines are based on a stochastic analysis of water use and bunkering activities, and are bound by the over-riding principle that a vessel must *never* run out of potable water.

In 2008, HAL gathered the following data regarding ship water sourcing:

Figure 3: Estimate of 2008 HAL Fleet Water Sourcing



Using this data, HAL has developed a model to compute “predicted values” of copper, nickel and zinc based on the average concentrations from the various sources, as well as the percentage of potable water obtained from those respective sources. This model will be used in developing a strategic bunkering guidance for 2009 itineraries in which we seek to minimize the introduction of copper, nickel or zinc to the potable water supplies on HAL ships. Westerdam and Zuiderdam are not modeled, as decisions regarding 2009 discharges in Alaska from these vessels have not been finalized.

The Alaska Cruise Association also gathered the following data regarding metal contaminants in bunkered water:

Figure 4: Average Metals Concentrations in Alaska Bunkered Water

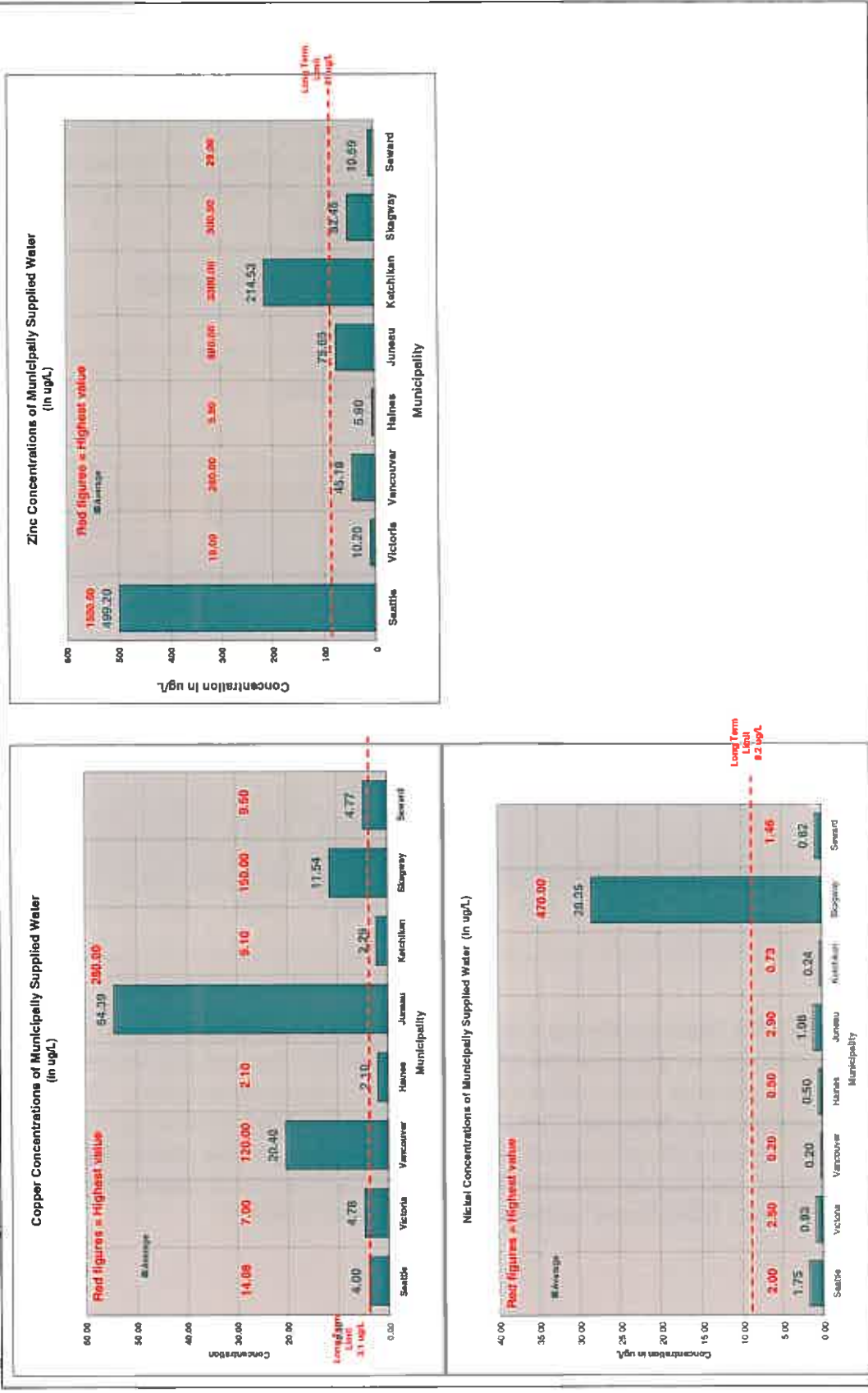
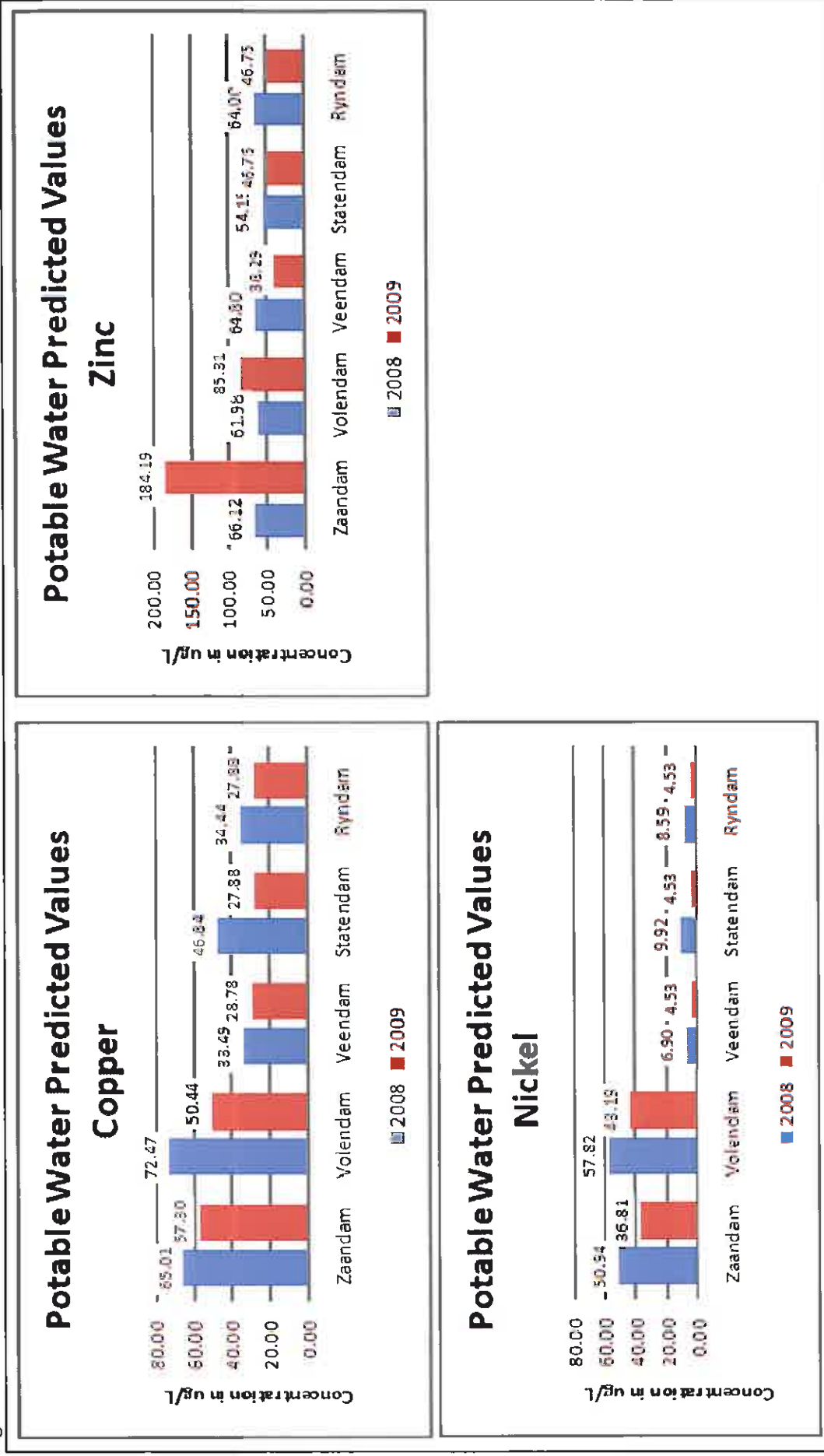


Figure 5: Predicted Potable Water Metals Concentrations - 2008 vs. 2009



It should be emphasized that the foremost consideration will be, of course, to assure that the vessel *never* runs out of water. As such, the ultimate decision making lies with the ship's officers. Factors such as daily usage, weather, availability in port, the number of other ships in port, etc. will affect the degree to which a given vessel will be able to conform to the guidance.

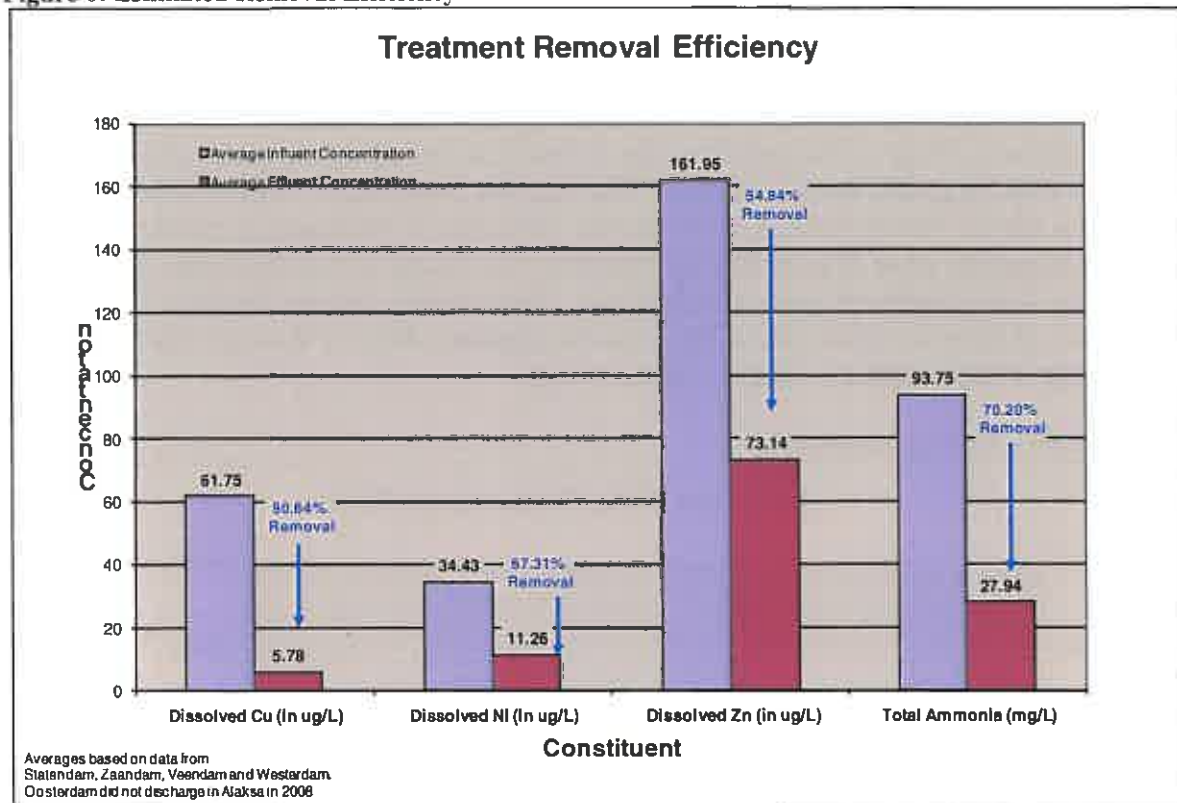
The charts at Figure 5 show that when using data already collected and applying it to compute "predicted values" for 2009 there is the potential for a substantial reduction in copper ranging from between a 12% to 40% and Nickel which ranges from between a 25% to 54%, a variable but substantial reduction across the fleet.

The model predicts the possibility of an increase in Zinc concentrations for some vessels. This data, however, is affected by outlying values measured in 2008 from terminal 30 in the Port of Seattle. In 2009 our Seattle ships will berth at the new terminal at Pier 91. We will be conducting sampling of Pier 91 water to determine the metals concentrations of that source. If the water bunkered at the new terminal is of a better quality for Zinc then the 2009 data may show improvement. This will not be substantiated until we are able to sample water supplied from the terminal. Additionally, the long-term-limit for Zinc is considerably higher than that for copper or nickel, meaning that it is still possible that effluent limits may be attained after membrane filtration.

Please note – these charts describe **potable** water – not the values measured in the actual effluent discharged under the Alaska Permit. As we have previously reported, the AWWPS systems have been shown to remove metals from the influent, as reflected in the figure 6 below. We therefore expect that reductions in potable water metals concentrations will result in lower effluent concentrations, although the degree of reduction cannot be predicted. Discharge Monitoring Reports (DMRs) submitted throughout the 2009 Alaska season will be the ultimate test of the success of this strategy.

The model/sensitivity analysis used to produce these predicted values is, to a certain degree, theoretical. Actual metals concentrations in the potable water system will include contributions from pipe leaching as well as minor concentrations from products used on board and even human waste. However we believe the model will be useful in guiding bunkering decisions and when evaluating data collected from the 2009 Alaska season (which will be governed by a strategic bunkering plan introduced to the fleet during the 2009 season) against the data received last year during the 2008 season. The ultimate test of effectiveness will be demonstrated in the Discharge Monitoring Reports submitted under the permit.

Figure 6: Estimated Removal Efficiency



To determine the effectiveness of this approach, we will not implement the strategic bunkering process in the early part of the Alaska season. The purpose will be to establish an operational baseline against which to measure subsequent results once the bunkering strategy is implemented. The base line samples for the bunkering plan will not be taken until mid June, this will ensure all ships will have been sailing and bunkering water in Alaska for a period of at least four weeks. Once the samples have been taken the ships will be forwarded a ship/itinerary specific bunkering plan which will outline the preferred ports to bunker water. We will then have a further three months to gather data under the plan before the results can be finalized.

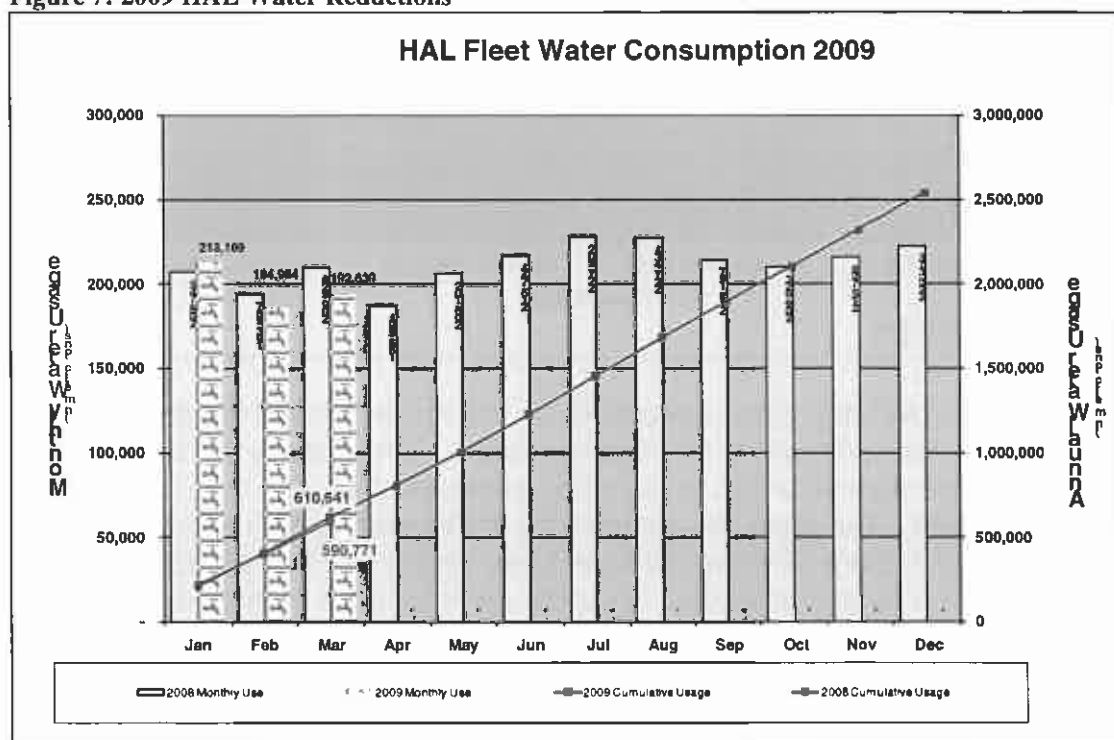
The following milestones are scheduled:

	Action	Estimated Completion
1	Baseline sampling to establish 2009 Alaska values prior to strategy implementation	June 15, 2009
2.	Sampling of Seattle Pier 91 bunkered water supplies	June 1, 2009
3.	Implementation of Strategic Bunkering Plan	June 15, 2009
4.	Bunkering per Strategic Plan	June 15 – September 2009
5.	Confirmation sampling	September 30, 2009

5. Water Use Reduction

HAL is engaged in water conservation activities designed to reduce the amount of potable water used on board. Projects include the use of low flow aerators for guest and crew cabin sinks, as well as public faucet fixture. This has the potential to reduce leaching and erosion of pipes which should have a consequent reduction in the mass of contaminants of concern. It is uncertain what impact this will have on discharge *concentrations*, as there will of course be less volume of water discharged. Regardless, the net environmental benefit will be evaluated to determine if this has the desired effect of less environmental loading of contaminants such as copper, nickel or zinc.

Figure 7: 2009 HAL Water Reductions

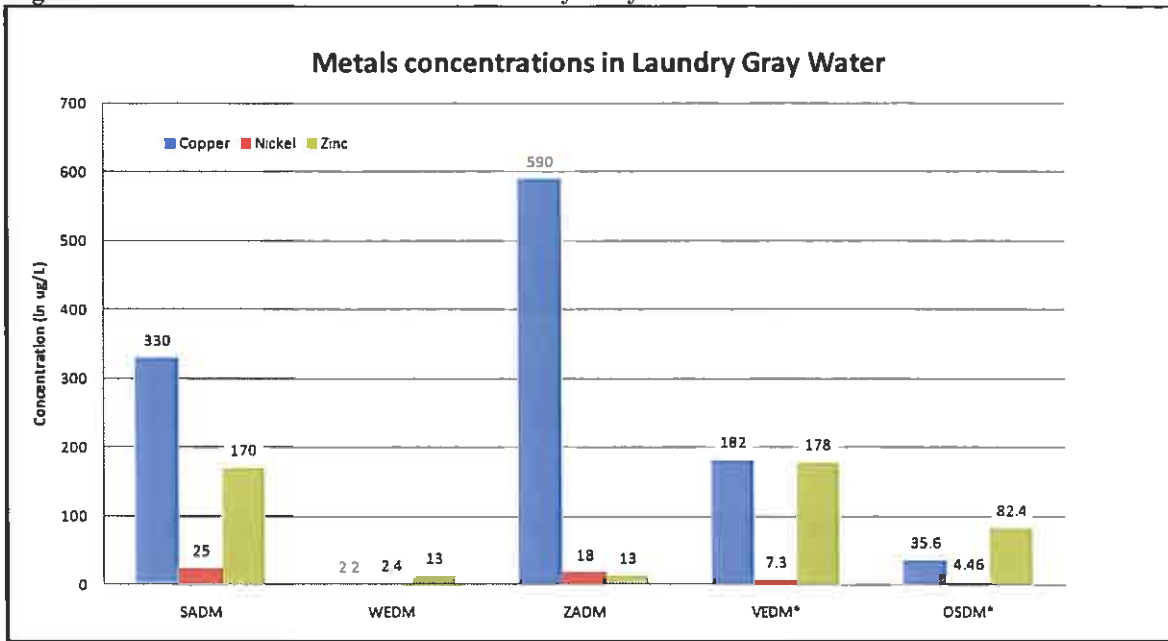


It is anticipated that installation will be complete throughout the Alaska fleet by July 15, 2009.

6. Laundry Water Investigation

The January 2009 Source Reduction Evaluation Annual Report identified laundry waste water has having significantly higher concentrations of copper, nickel and zinc. This is demonstrated in the following chart – based on data previously submitted to ADEC in the January 2009 Source Reduction Annual Report:

Figure 8: 2008 Metals Concentrations in Laundry Gray Water



HAL is exploring the use of "Ozonator" equipment that is designed to produce the same or better laundry results while using less water, lower water temperatures, and less laundry chemicals. These factors have the potential to impact the level of contaminants in the waste water. We are in discussions with a vendor offering a product of this nature, and we are looking to have a pilot installation placed on the Ryndam during the 2009 Alaska season.

Prior to selection and installation of the equipment, we must establish vessel infrastructure requirements such as plumbing, power needs, installation and operation. Additionally, laundry chemical formulations must be altered. As with other source reduction projects, it will be necessary to gather baseline data, conduct operational training, as well as follow-up analysis. The following schedule is expected:

	Action	Estimated Completion
1.	Confirmation of Vendor participation	May 30, 2009
2.	Baseline data gathering	June 15, 2009
3.	Identification of shipboard infrastructure requirements: Power, plumbing, water	June 30, 2009
4.	Shipboard modifications, installation & operator training	July 30, 2009
5.	Shipboard operations	July 30-Sept. 30, 2009
6.	Evaluation data gathering/ Analysis	Sept. 30, 2009

7. Nitrification Enhancement

On April 14th 2009, members of HAL's Technical Committee met with a representative of R&D Supply to discuss the possibility of employing treatment additives to enhance nitrification in the existing waste water treatment systems for improved ammonia reduction.

R&D Supply discussed two different paths. In one, carbonaceous bacteria known as "nitrosomas" could be added. These bacteria do not convert ammonia but rather consume it as a nutrient, thereby reducing ammonia concentrations.

In an alternate scenario, nitrifying bacteria could be added either to the bioreactors or the wastewater collection tanks, to enhance the ongoing nitrification already exhibited in both Zenon and Rochem systems.

These nitrifying bacteria have been shown to be effective in reducing ammonia concentrations in shore-based treatment facilities, but they are more sensitive and require stricter environmental controls. The following parameters must be maintained to sustain the population of these bacteria:

Parameter	Acceptable	Optimum
Dissolved Oxygen	>0.5 mg/L	1.0-2.0 mg/l
Temperature	40-95 F	77-95 F
pH	6.0-9.0	7.0-7.5
Ammonia residual	1.0-3.0 mg/L	2.0-3.0 mg/L
Ortho-phosphate Residual	0.5-2.0 mg/L	1.0-2.0 mg/L

Additionally, the bacteria must be refrigerated in storage, shipped overnight from the supplier's facilities in Pennsylvania, and managed properly as they are added to the bio-digester.

In preliminary planning, the Volendam has been identified as the proper vessel on which to conduct a pilot study. Volendam is particularly appropriate in that the Zenon system installed has two separate and parallel treatment "trains" that will allow a side by side comparison to evaluate the effectiveness of this possible solution.

As Volendam will not reach Vancouver BC until May 20th, a technical representative from R&D Supply will visit on Zaandam, the sister ship to the Volendam, on May 15th, 2009. This trip will be to evaluate the installed system and discuss:

1. Operational issues 2. Refrigerated storage requirements 3. Training requirements 4. Sampling techniques and requirements	5. Recordkeeping 6. Gathering of Baseline data 7. Sampling and analysis requirements
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Once this May 15th evaluation has been completed, HAL will draft a complete implementation plan providing detail on each element above. Preliminarily, we outline the following milestones:

	Action	Estimated Completion
1.	Shipboard visitation: audit and scoping	May 15, 2009
2.	Shipboard modifications as necessary (e.g. injection port, sampling ports, dedicated refrigerator unit)	June 15, 2009
3.	Establishment of baseline data	June 30, 2009
4.	Development of Shipboard procedures	June 30, 2009
5.	Shipboard training and Introduction of Nitrifiers	July 1, 2009
6.	Shipboard operations	July 30-Sept. 30, 2009
7.	Alaska Permit DMRs (data to be evaluated)	2009 Alaska Season
8.	Evaluation data gathering/ Analysis	Sept. 30, 2009

Appendix A: Steiner Spa and Salon Chemical Usage

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Rcvd ADEC
MAY 04 2009



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